Journal of the Society of Arts.

FRIDAY, SEPTEMBER 23, 1859.

ON THE RELATIVE POWER OF METALS AND ALLOYS TO CONDUCT HEAT.

BY F. CRACE CALVERT, F.R.S., AND RICHARD JOHNSON, F.C.S.

(*Concluded from page 681.*)

ALLOYS CONTAINING AN EXCESS OF THE WORSE CONDUCTING METAL.

The study of this class of alloys being most interesting, we have made many experiments in order to discover why the presence of one metal completely annihilates the conducting power of the other, especially when the latter is the better conductor of the two.

The following series will illustrate the above statement.

LEAD AND ANTIMONY.

Formula of the alloys and per-centage.	Found (Mean).	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
1Pb=61·61 1Sb=38·39	6·05	8·00	190	251
1Pb=47·60 2Sb=52·40	5·90	7·57	185	237
1Pb=34·86 3Sb=65·14	5·85	7·18	184	225
1Pb=28·63 4Sb=71·37	5·70	6·99	179	219
1Pb=24·30 5Sb=75·70	5·70	6·85	179	215

It will be perceived, on looking over the results obtained, that all these alloys conduct heat almost as if the square bars examined were composed of pure antimony, the conducting power of which is 6·12; for if lead, which has a conducting power of 9·17, had influenced the passage of heat through the bars, the conducting power of the alloys would have been much higher, as shown by the column of theoretical conductibility.

The same results were obtained with the following series, composed of bismuth and antimony:—

ANTIMONY AND BISMUTH.

Formula of the alloys and per-centage.	Found (Mean).	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
1Sb=37·74 1Bi=62·26	1·97	3·52	62	110
1Sb=23·26 2Bi=76·74	1·87	2·92	59	91
1Sb=16·81 3Bi=83·19	1·90	2·64	59	83
1Sb=13·17 4Bi=86·83	1·50	2·47	47	77
1Sb=10·82 5Bi=89·18	1·55	2·39	48	75

We now describe the most important series of this class of alloys, namely, that consisting of those composed of tin and copper. (See below, Copper and Tin, Table I).

It is very interesting to observe, that although these alloys contain such different quantities of copper, viz., from 9·73 to 34·98, and this of a good conducter of heat, still no influence is exercised by it on the conductibility of the alloys, for they all give the same results as if the square bar experimented upon were composed of pure tin. Another fact, which increases the importance of the

COPPER AND TIN.—Table I.

Formula of the alloys and per-centage.	Temperature of the 50 cub. cent. before beginning.	Temperature of the 50 cub. cent. after 15 minutes.	Conductibility found.	Mean.	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
	DEG.	DEG.					
Cu = 34·98 Sn = 65·02	20·8 19·8	34·0 33·1	13·2 13·3	13·25	17·80	415	558
Cu = 21·21 2Sn = 78·79	19·4 19·5	33·2 33·2	13·8 13·7	13·75	16·08	431	504
Cu = 15·21 3Sn = 84·79	19·2 19·45	33·80 32·85	13·6 13·4	13·50	15·33	423	481
Cu = 11·86 4Sn = 88·14	18·9 19·0	31·7 32·1	12·8 13·1	12·95	14·92	406	468
Cu = 9·73 5Sn = 90·27	19·4 19·7	32·0 32.4	12·6 12·7	12·65	14·65	396	459

COPPER AND TIN.—Table II.

Formula of the alloys and per-centage.	Temperature of the 50 cub. cent. before beginning.	Temperature of the 50 cub. ceat. after 15 minutes.	Conductibility found.	Mean.	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
	DEG.	DEG.					
Sn = 38·21 3Cu = 61·79	21 20·6	36·7 36·4	15·7 15·8	15·75	21·37	494	670
Sn = 31·73 4Cu = 68·27	18·2 18·0 19·3 18·4	23·1 23·1 25·25 23·30	4·9 5·1 4·95 4·90	4·96	21·88	155	686
Sn = 27·10 5Cu = 72·90	17·7 18·7 17·9	24·2 25·3 24·5	6·5 6·6 6·6	6·6	22·50	207	705

bronze alloys, is the difference which they present in their conductibility when they contain an excess of copper, not only with regard to the above series, but also between each alloy, all of which have a conducting power of their own. (See last page, Copper and Tin. Table II.)

The results obtained with Sn 4Cu were so extraordinary, that the bar first prepared was remelted and cast, from a fear that there might be in the mass some vacant space or hole impeding conduction; but as it yielded the same results when submitted to experiment, we decided to make a new bar, weighing most carefully the metals to be used and also the bar when cast; the loss being only 0·5 per cent., we were satisfied that the bar was sound, and still it gave the same figures as the bar first experimented with; and therefore we concluded that an alloy of tin and copper containing 68 per cent. of the latter metal, has a conducting power five times less than it should have according to theory. From the above results it is highly probable that these alloys of tin and copper, and especially the three last, are definite chemical compounds; for if they were mixtures, they would conduct heat in ratio to the equivalents of the metals composing them, and would not each have a peculiar and different conductibility. These views are substantiated by experiments which we have made with square bars composed of sectional parts of copper and tin. These bars were made by a very skilful optician of this town, Mr. Dancer, and the parts soldered together with tin solder in so thin a layer, that it did not occupy a space of 0·55 millim. in the five junctions.

The first two bars we employed were of the usual dimensions, and composed of cubes of copper and tin, each 1 cub. cent., arranged in the following order:—

Bar No. 1, 2 cubes of tin, 2 cubes of copper and 2 cubes of tin. Bar No. 2, 2 cubes of copper, 2 cubes of tin and 2 cubes of copper. The results arrived at were—

	Found (Mean).	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Bar No. 1	17·25	18·12	541	568
Bar No. 2	18·35	22·23	575	696

Therefore these two bars conduct heat nearly as the theoretical results indicate; the slight difference of 1 or 2 degrees between the obtained and calculated figures being probably due to the influence of the tin solder existing between each cube, and to the cubes not being perfect in all their dimensions. Still, what different results these bars give, as compared with alloys having nearly the same per-centage of tin and copper! for we have

			Obtained.	Calculated.	Silver = 1,000.	
					Found.	Calculated.
Bar No. 1. Tin	62·39	Conductibility	17·25	18·12	541	568
Copper.....	37·21					
	100·00					
Alloy:—						
1 equivalent of Tin.....	65·02	Conductibility	13·25	17·80	415	558
1 equivalent of Copper ...	34·98					
	100·00					
Bar No. 2. Tin	29·33	Conductibility	18·35	22·23	575	696
Copper.	70·67					
	100·00					
Alloy:—						
1 equivalent of Tin.....	31·73	Conductibility	4·96	21·88	155	686
4 equivalents of Copper ...	68·27					
	100·00					

These results appear to us perfectly to substantiate our views, viz., that these alloys are definite chemical compounds, and not a mixture of metals; for if they were the latter they would conduct heat as the bars, and would not have a conductibility of their own. We deemed it advisable to have a third bar made, in which the cubes of copper and tin alternated, and these are the results obtained—

	Found.	Mean.	Calculated.	Silver = 1,000.	
				Found.	Calculated.
Bar No. 3.....	18·1 18·3	18·2	20·22	570	634

The composition of this bar is intermediate between that of the alloys Sn 2Cu and Sn 3Cu, which contain in 100 parts (see top of next page):—

Notwithstanding these facts, we were not prepared for the curious results which we obtained with the following bar, composed of two longitudinal bars of tin soldered to two of copper and placed in juxtaposition (Bar No. 4); for although it contained in 100 parts the same weight of tin and copper as the last bar, it conducted heat at quite a different rate; in fact, its conductibility was the same as if the bar was entirely composed of pure copper, and did not contain half its bulk of tin.

	Found.	Mean.	Calculated.	Silver = 1,000.	
				Found.	Calculated.
Bar No. 4.....	26·5 26·4	26·45	20·22	829	634

These interesting results were confirmed by having

		Obtained.	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
1 equivalent of Tin..... 51·83 2 equivalents of Copper... 48·17 100·00	Conductibility	13·65	19·87	428	623
1 equivalent of Tin..... 38·21 3 equivalents of Copper... 61·79 100·00	Conductibility	15·75	21·27	494	670
Whilst the bar is composed of— Tin..... 45·36 Copper ... 54·64 100·00					
And conducts as a mixture, or		18·20	20·22	570	634

similar bars made of copper and zinc, (Bar No. 5) and copper and lead (Bar No. 6).

	Found.	Mean.	Calculated.	Silver=1,000. Found.	Silver=1,000. Calculated.
Bar No. 5. Copper 56·12 Zinc 43·88	26·8 26·9	26·85	23·33	842	731
Bar No. 6. Copper 43·42 Lead 56·58	23·0 23·1	23·05	16·42	723	515

We wished to ascertain if the extent of surface of the copper in contact with the other metal exercised any influence. We therefore had a bar made in which there was the same relative weight of tin and copper, but in which the surface of the two metals in contact was only one-half of that of the bar No. 4. This was effected by soldering together one bar of copper, 1 centim. wide and 5 millims. thick, to a similar one of tin (Bar No. 7); and although the results leave some doubt whether the surfaces have an action, still the figures are sufficiently different to deserve serious consideration.

	Found.	Mean.	Calculated.	Silver=1,000. Found.	Silver=1,000. Calculated.
Bar No. 7.....	24·2	24·15	20·22	757	634
Bar No. 4.....	26·5	26·45	20·22	829	634

The conductibility of these bars, and especially of Nos. 4 and 6, being equal to that of rolled copper, with which they had been made, we wished to see what would ensue, if bars of the same copper, and having the same diameter or surface as that of the copper in the above bars, were subjected to experiment. These are the results:—

Bar No. 8. Square copper bar of 7 millims. square, or one-half the bulk of the bar usually employed.

Found.	Mean.	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
19.1 19·1	19·1	17·73	599	591

Bar No. 9*. Bar of rolled copper, 5 millims. thick and 1 centim. wide.

Found.	Mean.	Calculated.	Silver = 1,000. Found.	Silver = 1,000. Calculated.
19·4 19·3	19·35	18·86	606	591

Therefore there cannot remain a doubt that the presence of tin, zinc, or lead in the bars exercises a marked action on the conductibility of the copper; for we have—

1 centim. square bar of rolled copper ..... 26·95
7 millims. square bar of rolled copper ..... 19·12
5 millims thick, 1 centim. wide } bar of rolled copper ..... 19·35
1 centim. square bar of rolled copper and tin. 26·45
1 centim. square bar of rolled copper and zinc 26·85
1 centim square bar of rolled copper and lead† 23·05

ALLOYS IN WHICH THERE IS AN EXCESS OF THE GOOD CONDUCTOR.

Having already described the peculiar properties presented by four of the bronze alloys, viz., those of Sn 2Cu, Sn 3Cu, Sn 4Cu and Sn 5Cu, we should have nothing more to add to them, if we did not wish to illustrate the extraordinary influence which tin exercises on the conductibility of copper, and also to show that when there is a great excess of a good conductor in an alloy, it overcomes the resistance of the bad conductor, and in consequence the conductibility of such alloys increases with the proportion of the good conductor.

	Obtained.	Calculated	Silver = 1,000. Obtained.	Silver = 1,000. Calculated
Sn = 27·10 5Cu = 72·90	6·60	22·50	207	705
Sn = 15·68 10Cu = 84·32	9·80	23·90	307	749
Sn = 11·03 15Cu = 88·97	12·82	24·50	402	768
Sn = 8·51 20Cu = 91·49	14·85	24·81	465	778
Sn = 6·83 25Cu = 93·17	15·15	25·02	475	784

* The surfaces in the vessels B and C of bar 9 being to our standard bar of copper 5 : 3·5 : : 26·95 : x=18·86.

† A metal having a very low conducting power.

ALLOYS OF BISMUTH AND ANTIMONY.

These alloys also show a gradually higher degree of conductibility as the number of equivalents of antimony increases in the compound.

	Obtained.	Calculated.	Silver = 1,000	
			Obtained.	Calculated.
Bi = 62·26 Sb = 37·74	1·97	3·52	62	110
Bi = 45·21 2Sb = 54·79	2·45	4·23	76	132
Bi = 35·48 3Sb = 64·52	2·55	4·63	80	145
Bi = 29·20 4Sb = 70·80	3·05	4·90	96	153
Bi = 24·81 5Sb = 75·19	3·45	5·08	108	159

ALLOYS OF ANTIMONY AND LEAD.

Owing no doubt to the slight difference of the conductibility of these two metals,

Antimony being ..... 6·12
Lead ..... 9·17

the influence of excess of equivalents of lead over those of antimony is not so striking in this series as in the preceding one. The following are the results observed:

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Sb = 38·39 2Pb = 61·61	6·05	8·00	190	251
Sb = 23·68 4Pb = 76·32	6·50	8·44	204	265
Sb = 17·20 6Pb = 82·80	7·05	8·64	221	271
Sb = 13·48 8Pb = 86·52	7·00	8·75	219	274
Sb = 11·08 10Pb = 88·92	7·35	8·83	230	276

ALLOYS OF ZINC AND COPPER.

The reason why we have kept these alloys all together, and have not divided them so as to bring them under the last two divisions, is, that they have a tendency to come entirely under the last division. We say a tendency, for they do not offer the distinctive degrees of conductibility that the alloys of copper and tin or bismuth and antimony present; but this may be due to the conducting powers of copper and zinc being within a few degrees of one another,

Cast Copper being ..... 25·87
Cast Zinc ..... 20·03

CONDUCTIBILITY OF COPPER AND ZINC ALLOYS.

	Obtained.	Calculated.	Silver = 1,000.	
			Obtained.	Calculated.
Cu = 49·32 Zn = 50·68	21·95	22·92	688	718
Cu = 32·74 2Zn = 67·26	13·65	21·91	428	687
Cu = 24·64 3Zn = 75·36	16·95	21·44	531	672
Cu = 19·57 4Zn = 80·43	18·80	21·14	589	663
Cu = 16·30 5Zn = 83·70	19·00	20·95	595	657

It is probable that Cu 2Zn and Cu 3Zn are definite compounds, for not only have they a special conducting power of their own far below that of the metals composing them, but also they are perfectly crystallized. The most splendid of all the brass alloys is the alloy Cu Zn, which is of a beautiful gold colour and crystallizes in prisms, often 3 centims. long. These crystals are also interesting on account of their extraordinary elasticity. It is surprising that so cheap an alloy has not been employed in commerce, for no commercial brass contains more than 30 to 35 per cent. of zinc, whilst the above one contains 50·68 of this metal. The only explanation that we can give of this fact is, that if copper be alloyed with more than 50 per cent. of zinc, the alloys formed do not possess the colour of brass, but become white as zinc, and therefore the manufacturers have never tried to unite these metals in the exact proportions given above. We say exact, for it is remarkable that a variation of a few per cent. in the relative proportions of the two metals no longer yields the beautiful alloy which we have noticed, but only a white and comparatively useless one.

ALLOYS WITH EXCESS OF COPPER.

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Zn = 33·94 2Cu = 66·06	19·80	23·80	621	748
Zn = 25·52 3Cu = 74·48	20·35	24·37	638	764
Zn = 20·44 4Cu = 79·56	21·25	24·67	666	770
Zn = 17·05 5Cu = 62·95	22·80	24·87	715	780

We also made a bar 1 centim. cub. square of zinc and copper, placing a cube of each metal alternately, as in No. 3 bar of tin and copper, and the result obtained is similar, for we have—

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Bar 10	22·5	23·33	705	731

The facts presented by a bar 1 centim. square, and composed of two longitudinal bars of copper and zinc, have been described under the bar No. 5.

We also thought that it might be useful if we were to analyse the following commercial alloys, and determine their respective conducting powers:—

	Found.	Calculated.	Silver = 1000,.	
			Found.	Calculated.
"Yellow brass." ... Cu = 64·0 Zn = 56·0	17·80	22·73	558	712
"Pumps and pipes" ... Cu = 80·0 Sn = 5·0 Zn = 7·5 Pb = 7·5	13·60	22·57	426	707
"Mud plugs" Cu = 80·0 Sn = 10·0 Zn = 10·0	12·60	24·00	394	754
"Large bearings ... ... Cu = 82·05 Sn = 12·82 Zn = 5·13	11·00	23·97	345	751

It is extraordinary to find what a low conducting power these alloys possess; for with the exception of the alloy named "Yellow brass," they do not conduct heat better than wrought and cast iron. This is due to the impurities of the metals employed, and shows the advantage that there will be in substituting for them some of the much cheaper alloys above described.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The twenty-ninth meeting of this Association commenced at Aberdeen, on Wednesday the 14th instant, under the Presidency of His Royal Highness the Prince Consort. The meeting has been well attended, and has been the largest in point of numbers of any hitherto held, with the exception perhaps of that at Newcastle. The number of applicants to join the Association was so great that on the Wednesday morning it became necessary to stop the issue of associate tickets—too great a crowd being apprehended at the meeting in the Music Hall in the evening, though that building was calculated to accommodate conveniently two thousand seven hundred persons. The hour fixed for the commencement of the proceedings was half-past seven, and nearly every seat was occupied immediately on the opening of the doors at seven o'clock. Professor Owen, the retiring President, in a short speech congratulated the Association on its prosperous condition, and then retired from the chair, which was taken by H. R. H. the Prince Consort, who proceeded to read his address, which occupied about forty minutes.

On Thursday morning, the 15th instant, the business of the sections commenced. The following papers were read:—

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

The Earl of Rosse, M.A., K.P., F.R.S., President.

1. Opening Address by the President.
2. Professor W. Thomson.—On the necessity for incessant Recording, and for simultaneous Observations in different localities, to investigate Atmospheric Electricity.
3. Professor Baden Powell.—Report on Luminous Meteors for 1858-9.
4. A. Cayley.—Provisional Report on the progress in the Solution of certain special problems in Dynamics.
5. John Thomas Townson.—Report on changes of Deviation of the Compass on board Iron Ships by "heeling;" with Experiments on board the "City of Baltimore," "Aphrodita," "Simla," and "Slieve Donard."
6. Fleeming Jenkin.—On the rapidity of Signalling through long Submarine Telegraphs; with remarks by Professor W. Thomson on the discharge of a coiled Electric Cable.

SECTION B.—CHEMICAL SCIENCE.

Dr. Lyon Playfair, C B., F.R.S., &c., President.

1. Opening Address by the President.
2. Professor G. Wilson.—On the Stages which led to the Invention of the Modern Air-Pump.
3. Dr. J. H. Gladstone.—On the Fluorescence and Phosphorescence of some Diamonds.
4. Messrs. Versmann and Oppenheim.—On the Comparative Value of certain Salts for rendering Fibrous Substances Non-inflammable.
5. Dr. S. Macadam.—On the Analysis and Valuation of Manures.

SECTION C.—GEOLOGY.

Sir Charles Lyell, LL.D., D.C.L., F.R.S., &c., President.

1. Opening Address by the President.
2. Professor Nicol, F.R.S.E., F.G.S.—On the Geology of Aberdeenshire.
3. Rev. John Longmuir, A.M., LL.D.— On Coast Section between Aberdeen and Dunnottar Castle.
4. A. Geikie, F.G.S —On the Chronology of the Trap Rocks of Scotland.
5. H. C. Sorby, F.R.S.—On the Origin of Cone in Cone Structure.
6. Rev. H. Mitchell.—On New Fossils from Lower Old Red Sandstone of Scotland.
7. Thomas F. Jamieson.—On the Junction of Granite with Stratified Rocks.

SECTION D.—ZOOLOGY AND BOTANY INCLUDING PHYSIOLOGY.

Sir W. Jardine, Bart., F.R.S.E., President.

1. Opening Address of President.
2. Dr. Dickie.—On the Characteristic of the Aberdeenshire Flora.
3. Professor Allman.—On a New Genus of Lucernariadæ.
4. Mr. Gould.—On some new species of Birds.
5. Rev. W. S. Symonds.—On Drift Pebbles found in the Stomach of a Cow.
6. Mr. Beattie.—Short Account of a Bone Cave near Montrose.
7. Dr. M'Bain.—Notice of the Skull of a Wombat from the Bone Caves of Australia.
8. Dr. Ogilvie.—On the Vegetative Axis of Ferns.
9. Dr. Murray.—On a Species of Galago from Old Calabar.

SUB-SECTION D.—PHYSIOLOGY.

Dr. Sharpey, F.R.S., President.

1. Professor Bennett.—On the Structure of the Nerve Tubes.
2. Dr. Redfern.—On the Admixture of Nervous and Muscular Fibres in the nerve of the Leech.
3. Bernard E. Brodhurst, F.R.C.S.—On the Repair of Tendons after their Sub-cutaneous Division.
4. M. Foster, M.B.—On the Beat of the Snail's Heart.
5. G. H. Lewes.—On the necessity of a Reform in Nerve Physiology.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

Admiral Sir James Clark Ross, D.C.L., F.R.S., President.

1. Professor Owen.—Report on the Crania of the Tribes of Nepaul.
2. Captain Sherard Osborn, R.N.—Geographical Remarks upon the Yangtse-Keang, with Observations upon its future Commerce.
3. John Craufurd, Esq., F.R.G.S.—On the Relation of the Domesticated Animals to Civilization.
4. John Hogg, F.R.S.—On Gebel Haurán—its adjacent Districts—and the Eastern Desert of Syria, with Remarks on their Geography and Geology.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

Colonel Sykes, F.R.S., M.P.—President.

1. The President.—Introductory Remarks.
2. John Strang, LL.D.—Church Building in Glasgow, shewing the number, size, and cost of the various places of Worship erected there during the last twenty years, through voluntary effort.
3. Dr. W. Moore, T.C.D., M.R.I.A.—Statistics of Small-Pox and Vaccination in the United Kingdom.
4. The Hon. Thomas M'Combie—Statistics of the Trade and Progress of the Colony of Victoria, Australia.

SECTION G.—MECHANICAL SCIENCE.

The Rev. Professor Willis, F.R.S., President.

1. Report of the Committee on Steam Ship Performance.
2. Admiral Moorsom.—On the Performance of Steam Vessels.
3. J. Oldham, C.E.—Report of the Progress of Steam Navigation at Hull.
4. Charles Atherton, communicated by H. Wright.—On Mercantile Steam Transport Economy, as affected by the consumption of Fuel.
5. J. Macquorne Rankine, LL.D.—A condensed Abstract of Experiments, by Messrs. R. Napier and Sons, on the Strength of Wrought Iron and Steel.

6. Donald Bain, communicated by H. Wright.—On Harbours of Refuge.
7. Vice-Admiral Moorsom.—On the Performance of Steam Vessels.

His Royal Highness, the President, visited each of the sections during the course of the morning. In the evening a Conversazione was held in the Music Hall. A large number of interesting objects were displayed for the inspection of the visitors. These consisted of a remarkable exhibition of historical portraits and objects of antiquity, as well as a fine collection of photographs, with microscopes, stereoscopes, &c.

On Friday morning, the 16th, the business of the sections was resumed, and the following is a list of the communications made :—

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

1. Sir William R. Hamilton.—On an application of Quaternions to the Geometry of Fresnel's Wave Surface.
2. Admiral Fitzroy.—On Aqueous Vapours and Atmospheric Waves.
3. Sir David Brewster.—On a New Species of Double Refraction.
4. J. B. Lindsay.—On the Transmission of Electricity through Water.
5. The Abbé Moigno.—On the Phonautograph for Registering Simple and Compound Sounds.
6. The Abbé Moigno.—Supplement to Newton's Method of Resolving Equations.
7. The Abbé Moigno.—Portable Apparatus for Analyzing Light, invented by M. Porro.
8. Colonel Sykes.—Report of the Balloon Committee.
9. J. Pope Hennessy.—On certain Properties of the Powers of Numbers.
10. A. Claudet.—On the Stereoscopic Angle.
11. A. Claudet.—On the Focus of Object Glasses.
12. A. Claudet.—On the Stereomonoscope.
13. A. Claudet.—On a changing Diaphragm for Double Achromatic Combinations.
14. H. R. Twining.—On the Angular Measurement of the Picture in Painting.

SECTION B.—CHEMICAL SCIENCE.

1. Abbé Moigno.—New Process of Preserving Milk perfectly pure in the natural state, without any chemical agent.
2. Dr. Lyon Playfair.—On a symmetrical representation of Oxides and Salts on a common type.
3. The Master of the Mint.—On the Molecular Movements of Fluids.
4. Mr. Walter Crum.—On the ageing of Mordants in Calico Printing. Communicated by Professor G. Wilson, with Observations and Illustrations.
5. Mr. Brazier.—Laboratory Memoranda.
6. Mr. Crace Calvert.—On the formation of Rosolate of Lime on Cotton fabrics in Hot Climates.
7. Mr. Crace Calvert.—On the Density of Alloys.
8. Mr. G. B. Buckton.—On Stib-ethyl.

SECTION C.—GEOLOGY.

1. W. H. Baily, F.G.S., Paleontologist to the Irish Geological Society.—On Sphenoptoris Hookeri and Ichthyolites, from Kiltorkan Hill, Kilkenny.
2. Dr. Bryce, F.G.S.—Notice of the discovery of Upper Silurian Fossils in the Devonshire Slates.
3. Dr. Black, F.G.S.—On Coal at Ambisheg, Isle of Bute.
4. Rev. Dr. Anderson, F.G.S.—On Human Remains in Superficial Drift.
5. Rev. Dr. Longmuir.—On the Remains of the Cretaceous Formation in Aberdeenshire.
6. T. F. Jamieson.—On Drift Beds of the North of Scotland.
7. John Cleghorn.—On the Submerged Forests of Caithness.
8. William Pengelly, F.G.S.—On the Ossiferous Fissures of Oreston.
9. G. D. Gibb, A.M., M.D., F.G.S.—On Canadian Caverns.

SECTION D.—ZOOLOGY AND BOTANY, INCLUDING PHYSIOLOGY.

1. Professor Owen.—On the orders of the class Reptilia, and their distribution in time.
2. Dr. Dyce.—On the identity of Morrhua vulgaris and M. punctata, hitherto described as distinct species.
3. Dr. Dickie.—On the upper limits of Cultivation in Aberdeenshire.
4. Professor Allman.—On a remarkable form of Parasitism in Pycnogonidæ.
5. Dr. Bennet.—On the Vegetable Ivory Manufactures of Birmingham.
6. Dr. Lankester.—On the failure of bright-coloured Flowers in Forest Trees to produce effect unless accompanied by abundance of green leaves, by Dr. Buist.
7. Mr. Stainton.—On the Distribution of British Butterflies.
8. Sir William Jardine, Bart.—Notice of Syrrhaptis paradoxus, by Mr. John Moore.
9. Dr. Macbain.—Notice of the Skull of a Seal.
10. Dr. Macbain.—Notice of the Skull of a Manatee.
11. Dr. Macbain.—Notice of the duration of life in the Actinia Mesembryanthemum when kept in confinement.
12. Professor Macdonald.—On the Osteology of Lophius piscatorius.

SUB-SECTION D.—PHYSIOLOGY.

1. John Adamson, M.D.—Lactation in an unimpregnated Female of Canis familiaris.
2. Professor Allman.—Report on the Reproductive Organs of the Hydroid Zoophytes.
3. George Ogilvie, M.D.—The Genetic Sycle in Organic Nature.
4. Professor Laycock.—Handwriting and Drawing of the Insane—as illustrative of some modes of Cerebral Functions.
5. Professor Bennett.—On the Origin of Morbid Growths, with reference to the Connective Tissue theory.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

1. Major Phillips.—On some curious Discoveries concerning the Settlement of the Seed of Abraham in Syria and Arabia.
2. Sir Andrew Leith Hay.—On the Vitrified Fort in Aberdeen.
3. Laurence Oliphant, F.R.G.S.—Notes on Japan.
4. John Craufurd.—On the Effects of the recent Gold Discoveries.
5. Professor Tennant.—Notes on a Nugget from Victoria, &c.
6. Hon. Thomas M'Combie.—On the Aboriginals of Australia.
7. Dr. M'Gowan.—On the native Inhabitants of Formosa.
8. Consul Petherie.—Exploration of the White Nile.
9. Captain Speke, R.N.—Discovery of Lake Nyanza in Central Africa.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

1. J. T. Mackenzie.—On the Trade and Commerce of India.

SECTION G.—MATHEMATICAL SCIENCE.

1. P. Le Neve Foster.—Report of the Patent Committee.
2. William Fairbairn, F.R.S.—On Experiments to determine the Efficiency of Continuous and Self-acting Breaks for Railway Trains.

3. J. F. Bateman, C.E., F.R.G.S.—Description of Glasgow Water Works.
4. R. Aytoun.—On a Safety Cage for Miners.
5. J. Abernethy, C.E.—On the rivers "Dee," forming the Ports of Aberdeen and Chester.

In the evening a general meeting of the Association took place in the Music Hall, to hear a discourse from Sir Roderick Murchison, the Director-General of the Geological Survey of the United Kingdom, upon the Geology of the Northern Highlands.

On Saturday, the 17th, the business before the Section was as follows:—

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

1. Rev. H. Lloyd.—On the Affections of Polarized Light reflected from and transmitted by thin plates.
2. Sir D. Brewster.—On a curious landscape inclosed in a piece of calcedony belonging to a lady, exhibited and explained.
3. The Astronomer Royal.—On the former and present position of the question of the secular acceleration of the Moon's motion.
4. Admiral Fitzroy.—On Atmospheric Waves.
5. The Abbé Moigno.—On a New Electro-medical Apparatus, by M. Ruhmkorff.
6. Abbé Moigno.—On Becquerel's Phosphoroscope.
7. J. P. Gassiot.—On the Stratified Electrical Discharge, as affected by a moveable glass ball.
8. J. P. Joule.—On Friction in Air.
9. B. Stewart.—On Radiant Heat.
10. Professor Maxwell.—On Mixture of the Colours of the Spectrum.
11. G. J. Stoney.—Note on the propagation of Waves.
12. Mungo Ponton.—On Chromatic Dispersion.
13. Mungo Ponton.—On Wave Lengths of different rays.
14. J. J. Walker.—On the Iris seen in Water.
15. Colonel Shortrede.—On Proportional Compasses.
16. Colonel Shortrede.—On calculating Lunars.
17. Thomas Sutton.—On a new Photographic Lens.
18. J. Smith.—On the Cause of Colour.

SECTION B.—CHEMICAL SCIENCE.

1. Professor Maskelyne.—Report on the Chemical Characters of the Photographic Image.
2. Dr. Gladstone.—To exhibit a Photograph of Fluorescent Substances.
3. M. l'Abbé Moigno.—To exhibit Two Photo-Chemical Experiments by M. Niepce de St. Victor; and a Collection of Photographs in Charcoal and Metallic Powder, and Photographic Enamels.
4. MM. Isoard.—On a New Mode of generating illuminating Gas by means of Super-heated Steam and any Hydro-Carbon.
5. Dr. Phipson, of Paris.—Composition of a recently-formed Rock on the Coast of Flanders. Communicated by M. l'Abbé Moigno.
6. Dr. Phipson, of Paris.—Composition of the Shell of Cardium Edule (Common Cockle).
7. Dr. Sullivan.—Preliminary Report on the Solubility of Salts.
8. Mr. A. Gages.—First Report on Mechanico-Chemical Analysis of Rocks.
9. Professor Tennant.—On Gold Nuggets from South Australia.
10. Mr. J. M'Donnell.—On the Action of Air on Alkaline Arsenites.
11. Mr. T. Spencer.—On the Supply and Purification of Water.

SECTION C.—GEOLOGY.

1. Henry C. Hodge.—On the Origin of the Ossiferous Caves of the Plymouth Limestone, with deductions from the observed facts.
2. D. Page, F.G.S.—Report on the Exploration of the Upper Silurians of Lesmahago, in terms of the Association's grant to Mr. Slimon.
3. D. Page, F.G.S.—On some new Boreal Forms from the Pleistocene Deposits of Scotland.
4. Rev. Dr Longmuir.—On Restoration of Pterichthys.
5. Rev. W. S. Symonds, F.G.S.—On some Fishes and Tracks from the Passage Rocks, and from the Lower Old Red Sandstone of Herefordshire.
6. J. Miller, F.G.S.—On some New Fossils from the Old Red Sandstone of Caithness.
7. Professor Daubeny, F.R.S.—On certain Volcanic Rocks in Italy, which appear to have been subjected to Metamorphic action.
8. Dr. Macgowan.—On certain Phenomena attendant on Volcanic Eruptions and Earthquakes in China and Japan.
9. Messrs. Garner and Molyneux.—On the Coal-fields of Staffordshire.
10. Dr. Buist, F.G.S.—On the Geology of Lower Egypt.

SECTION D.—ZOOLOGY AND BOTANY, INCLUDING PHYSIOLOGY.

1. Dr. G. Wilson.—On the Employment of the Electrical Eel, Gymnotus Electricus, by the Natives of Surinam.
2. Dr. Bleeker.—On New Genera of Fish from Java.
3. Dr. Dickie.—On the Structure of the Shell of some Species of Pecten.
4. Dr. Dickie.—On the Flora of the Shores of Davis' Straits, by Mr. James Taylor.
5. Dr. Dickie.—Remarks on the Greenland and Iceland Falcons, by Mr. James Taylor.
6. Mr. C. W. Peach.—Catalogue of Zoophytes of Caithness, especially around Wick.
7. Mr. Croall.—Notes on Braemar Plants.
8. Mr. Yates.—On the Cones of Cycads.
9. Dr. Ogilvie.—Report of the Dublin Bay Dredging Committee.
10. Dr. Lankester.—Notice of an Infusorial deposit in the Island of Lewis.
11. Dr. Lankester.—The Growth of Trees in Continental and Insular Climates, by Daniel Vaughan.
12. Dr. Lankester.—Report on the Growth of Plants, by Professor Buckman.
13. Mr. Price.—On the Genus Cydippe.

SUB-SECTION D.—PHYSIOLOGY.—Did not meet this day.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

1. Thomas Mitchell, Esq.—The Russian Trade in Central Asia.
2. The Rev. S. Hislop, F. C. Missionary.—On the Aboriginal Tribes of the Province of Nagpore, Central India.
3. Baron de Bode.—On the Country to the West of the Caspian Sea. Communicated by Dr. Hodgkin.
4. John Stuart, Sec. Soc. Ant. Scot.—On the Sculptured Stones of Scotland.
5. Colonel Jonathan Forbes, A.M.—On the Ethnology and Hieroglyphics of the Caledonians.
6. J. Lyons M'Leod, F.R.G.S.—Notes on the Geography of Eastern Africa, communicated by Sir R. I. Murchison.
7. John Hogg, F.R.S.—On the Karaite Jews.
8. R. Cull, F.R.S.—To exhibit Two Axe Heads brought by P. O. Callaghan, Hon. Sec. Leeds Philosophical Society.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

1. Alexander Thomson, of Banchory.—On the Aberdeen Industrial Feeding Schools.
2. John Craufurd, F.R.S.—On the Effects of the Influx of the Precious Metals which followed the Discovery of America.

3. Henry Fawcett, M.A., F. Trin. Hall, Cambridge.—On the Social and Economical influence of the New Gold.
4. Ar. Harvey.—On the Statistics of Agriculture of Aberdeenshire.
5. G. B. Bothwell.—On the Manufactures and Trades of Aberdeen.

SECTION G.—MECHANICAL SCIENCE.

1. J. F. Bateman.—On the Result of Boring for Water in the New Red Sandstone near Shiffnall, in the County of Salop.
2. W. Robertson, communicated by Peter Spence.—On a Patent Chain Propeller.
3. Admiral Paris, C.B.—On the Manœuvring of Screw Vessels.
4. Arthur Taylor, communicated by H. Wright.—On the True Action of what are called Heat Diffusers.
5. A. Batten.—On a Boat-Lowering Apparatus.
6. E. A. Wood.—On a Mode of Suspending, Disconnecting, and Hoisting Boats attached to Sailing Ships and Steamers at Sea.
7. D. K. Clark, C.E., communicated by H. Wright.—On Smokeless Coal-burning Locomotive Engines.

On Monday the 19th, the Sections resumed their business, when the following papers were read:—

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

1. H. A. S. Smith.—Report on the Theory of Numbers.
2. G. J. Symons.—Report on Thunder Storms.
3. Professor Tyndall.—On the Establishment of Thermometric Stations on Mont Blanc.
4. Sir D. Brewster.—On the connexion between the Solar Spots and Magnetic Disturbances.
5. Professor Lindelöf.—On the Calculus of Variations.
6. W. De la Rue.—On Celestial Photography.
7. H. Cox.—On the Submergence of Telegraphic Cables.
8. Professor W. Thomson.—On Electrical "Frequency."
9. Fleeming Jenkin.—On Gutta Percha as an Insulator at various temperatures.
10. Sir D. Brewster.—On Sir Christopher Wren's Cypher containing Three Methods of finding the Longitude.
11. C. F. Varley.—On Methods of Finding the Position of a Fault in a Submarine Cable.
12. J. Park Harrison.—On Lunar Influence on Temperature.
13. A. Cruickshank.—On the Transparency of the Atmosphere.
14. Rev. T. Rankin.—Meteorological Observations.

SECTION B.—CHEMICAL SCIENCE.

1. Dr. Odling.—On a New Mode of Bread-making.
2. Drs. Odling and Dupré.—On the Composition of Thames Water.
3. Mr. G. C. Foster.—Report on the Recent Progress and Present State of Organic Chemistry.
4. Notice of Dugong Oil.—Communicated by Mr. Brazier.
5. Mr. Binney.—On the Solubility of Bone-earth from various sources in solutions of Chloride of Ammonium and common Salt.
6. Professor Voelcker.—Report on Field Experiments on the essential Manuring Constituents of Cultivated Crops.

SECTION C.—GEOLOGY.

1. C. Moore, F.G.S.—On Brachiopoda, and on the development of the loop in Terebratella.
2. Dr. Dawson, F.G.S.—A letter to Sir Charles Lyell on the occurrence of a Land Shell and Reptiles in the South Joggins Coal-field, Nova Scotia.
3. Professor Nicol, F.S.S.E.—On the Relations of the Gneiss, Red Sandstone, and Quartzite in the North West Highlands.
4. Professor Huxley, F.R.S.—On the newly discovered Reptilian remains from the neighbourhood of Elgin.
5. Professor Harkness.—On the Yellow Sandstones of Elgin and Lossiemouth.
6. J. Miller.—On the age of the Reptile Sandstone of Morayshire.
7. C. Moore, F.G.S.—On the Supposed Wealden and other beds near Elgin.
8. Rev. Dr. Anderson, F.G.S.—On Dura Den Sandstone.

SECTION D.—ZOOLOGY AND BOTANY, INCLUDING PHYSIOLOGY.

1. Mr. F. Jamieson.—List of the Birds of the North of Scotland, with their Distribution.
2. Dr. Lankester.—Description of New Species of Polyzoa and Echinodermata from Shetland.
3. A. Murray.—On the Disguises of Nature, with Illustrations.
4. Dr. Dickie.—On the Mollusca of Aberdeenshire.
5. Mr. Gould.—On Birds of Paradise.
6. Professor Allman.—On certain Forms of Marine Invertebrata, obtained by some recent dredging in the Orkney Seas.
7. Dr. Lankester.—Exhibition of Drawings of British Spiders.
8. Mr. Hogg.—Account of a Species of Phalangista, recently shot in the County of Durham.
9. Dr. MacGowan.—Remarks on the Cultivation of the Opium Poppy of China.
10. Dr. Redfern.—On the Structure of the Otolites of of the Cod (Gadus Morrhua).
11. Dr. Redfern.—Note on the Method of Production of Sound by a species of Notonecta.
12. Mr. Peach.—Notes on different subjects in Natural History, illustrated by specimens.

SUB-SECTION D.—PHYSIOLOGY.

1. Robert Garner, F.L.S.—Reproduction in Gasteropoda, and on some curious Effects in Endosmosis.
2. William Marcet, M.D., F.R.S.—An Experimental Inquiry into the action of Alcohol on the Nervous System.
3. Professor Bennett.—On the Molecular Theory of Organisation.
4. W. C. E. Nourse, F.R.C.S.—On the Organs of the Senses, and on the Mental Perceptive Faculties.
5. A. B. Garrod, M.D., F.R.S.—On the Specific, Chemical, and Microscopical Phenomena of Gouty Inflammation.
6. G. H. Lewes.—On the supposed distinction between Sensory and Motor Nerves.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

1. Major J. Stokes, R.E.—Notes on the Lower Danube.
2. Consul Dalyell.—Memorandum of Earthquake at Erzerum.
3. Consul S. Freeman.—Description of Ghadamès. Communicated by the Earl of Ripon.
4. Dr. Kirk, M.D., and Captain Bedingfield.—Notes from the Zambesi Expedition under Dr. Livingston. Communicated by Dr. Shaw.
5. Dr. Hector.—Description of Passes through the Rocky Mountains. Communicated by Sir R. I. Murchison.
6. Major Synge, R.E.—Rapid communication between the Atlantic and the Pacific, *via* British North America.
7. Dr. Norton Shaw.—Notes on the proposed Railway communications between the Atlantic and Pacific Oceans, *via* the United States of America.
8. William Bollaert, F.R.G.S.—On the Geography of Southern Peru.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

1. J. Pope Hennessy.—Results of the Society of Arts' Examinations.
2. Professor George Wilson, M.D.—Some Statistics on Colour-blindness.
3. The President.—The Past, Present, and Prospective Financial Condition of British India.

SECTION G.—MECHANICAL SCIENCE.

1. Abbé Moigno.—On a new Gas-burner.
2. Abbé Moigno.—On an Automatic Injector for feeding boilers, by Mr. Giffard.
3. Abbé Moigno.—On a Heliço-meter, an instrument for measuring the thrust of the Screw-propeller.
4. Abbé Moigno.—On an application of the moving power arising from tides to manufacturing, agricultural, and other purposes; and specially to obviate the Thames nuisance.
5. Alexander Gibb.—Description of the Granite Quarries of Kincardineshire.
6. { Alexander Allan.—On Gas Meters. / Alexander Allan.—Description of an Improved method of obtaining a true Liquid Level.
7. John Robb.—On the comparative Value of Propellers.
8. Alexander Gerard.—An experimental illustration of the Gyroscope.

At three o'clock the General Committee met, when it was unanimously resolved that the next meeting of this Association be held at Oxford, under the presidency of Lord Wrottesley.

Invitations were received from Cambridge, Manchester (for 1861), and Birmingham.

General Sabine, who has been General Secretary to the Association for twenty years, resigned his office, and Professor Walker, of Oxford, was elected in his place.

In the evening a general meeting was held in the Music Hall, at half-past eight, to hear the discourse of Dr. Robinson, Director of the Armagh Observatory, "On Electrical Discharges in highly-rarified Media." The discourse was illustrated by a series of very beautiful experiments, performed with the assistance of Mr. Gassiot and Mr. Ladd.

Tuesday, 20th September.—The sections met this morning, and proceeded with their business. The following papers were read:—

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

1. Dr. Lee.—On three Variable Stars, R. and S. Ursae Majoris and U. Geminorum, as observed consecutively for six years by Mr. Pogson.
2. N. Pogson.—On an improvement in the Heliometer.
3. Professor J. Thomson.—On recent Theories and Experiments on Ice at its melting point.
4. W. R. Birt.—On the Mid-day Illumination of three Lunar Craters.
5. J. B. Lindsay.—On Chinese Astronomy.
6. Sir David Brewster.—On the decomposed glass found at Nineveh and other places.
7. Sir David Brewster.—On the Fall of Rain in Forfarshire.
8. Rev. J. C. Clouston.—On the Climate of Orkney.
9. M. P. Sandeman.—On Meteorology of British Guiana.
10. Professor Hennessy.—On Mild Winters in the British Isles.
11. Astronomer Broun.—On the Annual Variation of the Barometer.
12. G. F. Harrington.—On the Theory of Light.
13. G. V. Towler.—On the Cause of Magnetism.
14. T. Davies.—On the Diurnal Variation of the Barometer.
15. C. Willich.—On the Angles of Dock Gates, and the Cells of Bees.
16. R. Campbell.—On the Probability of Uniformity in Statistical Returns.
17. A. S. Wilson.—On a System of Moving Bodies.
18. Sir C. Grey.—On the Longitude.
19. James Smith.—On the Relations of a Circle inscribed in a Square.

SECTION B.—CHEMICAL SCIENCE.

1. Mr. F. Ransome.—On Soluble Silicates, and some of their applications.
2. Mr. T. Segelcke.—Notes on the Current Methods for estimating Cellulose, or "Woody Fibre," in Vegetable Food-stuffs.
3. Messrs. Lawes and Gilbert.—On the Effects of different Manures on the Composition of the Mixed Herbage of Meadow Land.
4. Dr. Macvicar.—On the Organic Elements and their relations to each other and to the medium of light, illustrated by Models according to the Author's theory of the forms and structures of the Molecules of Bodies.
5. Dr. Dalzell.—On Crystallized Bi-chromate of Strontia.
6. Dr. Dalzell.—On the Economical preparation of pure Chromic Acid.
7. M. L'Abbé Moigno.—On Corne and Demeaux's disinfecting and deodorizing Powder.
8. M. L'Abbé Moigno.—On Matches without Phosphorus or Poison.
9. M. L'Abbé Moigno.—To exhibit a Nephogene, capable of being adapted to many chemical, therapeutic, and hygienic purposes.
10. Dr. Wallace.—On the Equivalent of Bromine.
11. Dr. Wallace.—On proposed Improvements in the Manufacture of Kelp.
12. Dr. Daubeny exhibited Specimens of several varieties of Volcano Tuff, from the neighbourhood of Rome and Naples.
13. Dr. Guthrie.—Reports from the laboratory at Marburg.
14. Mr. Napier.—New process of etching glass in relief, by hydrofluoric acid. Communicated by Professor Wilson.

SECTION C.—GEOLOGY.

1. Rev. Professor Sedgwick, F.R.S.—On Faults in Cumberland and Lancashire.
2. Profcssor Rogers, F.R.S.—On some observations on the Parallel Roads of Glenroy.
3. D. Page, F.G.S.—On the Structure, Affinities, and Geological range of Eurypteridœ.
4. Professor Harkness, F.R.S.—On Sections along the Southern flanks of the Grampians.
5. J. Wyllie.—On some Old Red Sandstone Fossils.
6. C. W. Peach.—On New Fossil Fish from Caithness.
7. W. H. Baily, F.G.S.—On Tertiary Fossils of India.

SECTION D.—ZOOLOGY AND BOTANY, INCLUDING PHYSIOLOGY.

1. Mr. Peach.—Exhibition of Objects of Natural History.
2. The Rev. W. S. Symonds.—On the Fish Rain of Aberdare, Glamorganshire.
3. Dr. Adams.—On the birds of the District of Banchory.
4. Mr. Price.—On the Genus Cydippe.
5. T. M. Masters, Esq.—On the Vegetable Morphology.
6. Mr. Nourse.—On the Colours of Leaves and Plants.
7. Mr. Lowe.—On the Temperature of Flowers.
8. Mr. Nourse.—On the Habits and Instincts of the Chameleon.
9. Mr. S. M. Burnett.—Personal Observations on the Zoology of Aberdeenshire.
10. Dr. Buist.—On the Aversion of Certain Plants to each other's neighbourhood.

11. Dr. Buist.—On the Bombaceæ of Western India.
12. Dr. Dickie.—Report of the Belfast Dredging Committee.

SUB-SECTION D.—PHYSIOLOGY.

1. G. H. Lewes.—A Demonstration of the Muscular Sense.
2. George Rainey, M.R.C.S.—On the Structure and Mode of Formation of Starch Granules, according to the principle of Molecular Coalescence.
3. John Denis Macdonald, R.N., F.R.S.—On the Homologies of the Coats of Tunicata, with Remarks on the Physiology of the Pallial Sinus System of Brachiopoda.
4. Richard Fowler, M.D., F.R.S.—A second Physiological attempt to unravel the perplexities of the Hypothesis of Berkeley.
5. Edward Smith, M.D., LL.B.—On the Sequence observed in the Phenomena observed in Man under the Influence of Alcohol.
6. Alphonse Gages, M.R.S.A.—On the comparative action of Hydrocyanic Acid on Albumen and Caseine.
7. William Camps, M.D.—On Certain Subjective Sensations, with especial reference to the Phenomena of Second Sight, Visions, and Apparitions.
8. William Camps, M.D.—On certain imperfectly recognised functions of the Optic Thealami.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

1. Colonel James, R.E.—On his Geometrical Projection of Two-thirds of the Sphere, and its application to the representation of the Stars.
2. Colonel James, R.E.—On the Roman Camp at Ardoch, and the Military Works near it.
3. Captain Speke.—On the Commercial Resources of Zanzibar on the East Coast of Africa.
4. J. Barnard Davies, F.S.A.—On the Native Inhabitants of the Taraï of the Sub-Himalaya.
5. Mr. Antonius Ameuney (a Syrian).—On the Arabic speaking population of the World.
6. Dr. M'Gowan.—Chinese Genealogical Tables.
7. Admiral Fitzroy.—On Meteorology, with reference to Travelling, and the Measurement of the Height of Mountains.
8. Dr. W. Camps.—On the Laws of Consanguinity and Descent of the Iroquois.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

1. Sir John S. Forbes, Bart.—On Popular Investments.
2 Dr. Macgowan.—On the Trade Currency of China (with specimens of the coinage).
3. Colonel Shortrede.—On Decimal Coinage.
4. J. Valentine.—Notes on the Vital and Economic Statistics of Aberdeen.
5. R. Valpy.—On the British Trade with India. Communicated by E. Macrory.
6. Rev. W. Caine, A.M.—On the Progress of Public Opinion, with respect to the evils produced by the Traffic in Intoxicating Drink, as at present regulated by law.
7. Col. Sir J. Alexander.—On the Arts of Camp Life.
8. J. Valentine.—Notes on Illegitimacy in the City of Aberdeen compared with the principal Towns in Scotland.
9. J. Pope Hennessy.—On some Questions relating to the Incidence of Taxation.
10. R. L. Johnson.—On Decimal Coinage.
11. C. W. Peach.—Statistics of the Whale Fishery at Peterhead.

SECTION G.—MECHANICAL SCIENCE.

1.—William Fairbairn.—Experimental researches to determine the density of Steam at various temperatures.
2. J. Elder.—On the Steam Machinery of the Callao, Bogota, and Lima.
3. J. P. Joule, LL.D., F.R.S.—On Surface Condensation.
4. Mr. Rettie.—On a Submarine Lamp.
5. G. Johnstone Stoney.—On the advantages of the 40-inch Metre as a Measure of Length.
6. Andrew Henderson.—On India River Steamers and Tow-boats—giving an account of their improved construction for light draft, capability for cargo, and fittings, conducive to manageability in shallow rapid rivers, &c., and of the practical value of the Dynamometer in showing the resistance of vessels in tow, at different speeds and loads, with the result of test-trials made in England.
7. G. Hart.—On Gas Carriages for Lighting Railway Carriages with coal instead of oil.
8. Captain J. Addison.—On Coal-pit Accidents,
9. H. Johnson.—On a deep-sea Pressure Gauge.
10. Mr. Davies, F.R.S.A., F.L.S.—On a Patent Dix Pan for evaporating Saccharine solutions and other liquids at a low temperature.
11. Adam Topp will describe various Modes of Fire Escapes, Boats, &c.

Most of the sections concluded their business this morning, and do not meet any more.

In the course of the morning, after the business of the sections was over, a large party visited the Rubislaw Granite Quarries, and had the gratification of witnessing the operation of blasting, Messrs. Gibb and Son, the proprietors of the quarries, having kindly made special arrangements for the purpose. Three blasts took place, and all were successful.

In the evening a Conversazione was held at the Music Hall, which was well attended. The electrical experiments, illustrating Dr. Robinson's discoveries of the previous evening, were repeated.

Excursions took place during the week to Benachie, to the vitrified fort on the Tap o'Noth, to Banff, and to Elgin, also to Stonehaven and Dunnottar Castle.

The following manufactories were open to members on producing their tickets:—Messrs. Jas. Abernethy, Iron-foundry; Messrs. Catto, Thompson, and Co., Rope and Iron Wire Work; Messrs. Alex. Duthie and Co., Shipbuilding; Messrs. J. Gibb and Son, Granite Quarries; Messrs. J. Hall and Son, Shipbuilding; Messrs. Walter Hood and Co., ditto; Mr. Wm. Keith, Jun., Enamelled Slate and Polished Granite Works; Messrs. Macdonald, Polished Granite Works; Messrs. M'Kinnon and Co., Iron Foundry; Messrs. John Moir and Sons, Preserved Provision Works; Messrs. Al. Pirie and Sons, Paper Works; Messrs. Robinson, Crum, and Co., Cotton Mill; Messrs. Stewart R. Stewart and Co., Comb Work; Messrs. Thomson, Hall, Catto, and Co., Engineering Works; Mr. James Wright, Polished Granite and Marble Works.

REFORM IN THE PATENT LAWS.

In Section G of the British Association at Aberdeen, the following Report of the Committee on the Patent Laws was read:—

At the meeting of the British Association at Leeds, for the year 1858, a committee was reappointed for the purpose of taking such steps as may be necessary to render the Patent System of this country, and the funds derived from inventors, more efficient and available for the reward of meritorious inventors and the advancement of science.

Circumstances beyond control have prevented that committee from taking any decisive steps in furtherance of the important objects entrusted to them; but those objects have not been lost sight of. No reply has been received from the Commissioners of Patents, either to the memorial of the Glasgow Committee of the British Association, or of the Public Meeting in Manchester; but some of the questions referred to in those memorials are adverted to in the Report of the Commissioners just issued. From that report, it appears that the number of applications for Patents may be estimated at about 3000 per annum—that of these 3000 applications, not more than about two

thousand proceed to the final stage of a Patent; and that of the two thousand Patents granted not more than 550 are kept alive beyond three years by the first periodical payment of £50 before the expiration of that term; and the Commissioners anticipate that the fee of £100, payable at the end of the 7th year, will not be paid on more than 100 of the surviving 550 patents. Should this anticipation prove correct, the payment by inventors in fees upon patents not surviving beyond one-half their term of 14 years, will not be less than at the rate of £100,000 per annum, as a direct tax on the inventive genius of the country in addition to, and exclusive of time, labour, and other charges and expenses. The total outlay in respect of those patents may be estimated as at least £250,000, or a quarter of a million per annum. The great work of printing and publishing *in extenso* the Specifications of Patents, granted under the old law—that is, from 1711 to the 1st October 1852, in number 12,977—is completed, and the surplus funds hitherto absorbed by this object will be henceforth available for other purposes. That surplus is estimated by the Commissioners at £30,000 for the current year, 1858-9, and to increase in each succeeding year at the rate of £20,000 per annum. This surplus, after providing for the current expenses, is proposed by the Commissioners to be appropriated to the following objects:—

1. The erection of a museum for the preservation and exhibition of models, of which a considerable collection already exists at Kensington.

2. The erection of suitable offices for the Commissioners, including a free library of consultation, upon a more extended scale than already formed by Mr. Woodcroft.

These most desirable and legitimate objects for the application of the "Inventors' Fee Fund," cannot however be attained without the sanction of the Lords Commissioners of Her Majesty's Treasury and a vote of Parliament, inasmuch as all the fees levied on inventors are, by a recent change, levied in the shape of stamps, and so pass directly into the Consolidated Fund. These recommendations of the Commissioners will, it is conceived, be regarded as a most legitimate application of the funds of Inventors, and as one to which the Parliamentary Committee of the British Association will give their aid, but your committee think that other considerations and other claims upon the Inventors' Fee Fund, and upon the annual surplus, whatever its probable amount, should be forthwith urged upon the Commissioners and upon Parliament.

The report of the Patent Committee of the British Association to the Leeds Meeting called prominent attention to the two following questions:—

1st. Whether the present scale of payment would be maintained or reduced so as to leave no greater surplus than necessary for official expenses?

2d. If the present scale of payment be maintained, how shall the surplus be appropriated?

The Commissioners of Patents are in favour of maintaining the present scale of payments, on the ground "that any material reduction in the amount of fees, would undoubtedly tend to increase the number of useless and speculative patents, in many cases taken merely for advertising purposes."

Your committee are not insensible to the force of this observation, but they beg respectfully to doubt whether this money check has any effective operation on the class of cases most requiring to be controlled, and whether the remedy is not worse than the disease in laying an unjustifiable burden on the inventive genius of the country, and effecting confiscation of property of its own creation.

Your committee are much struck with the fact that the application for about 1,000 patents is not prosecuted to completion, and in many cases probably not beyond the first stage; and that the first periodical payment of £50 at the end of the third year is not made in respect of nearly 1500 of the 2000 patents granted; and that the Commissioners anticipated during the ensuing year the surrender or lapsing of no less than 450 out of the 550 patents which survived the first periodical payment.

It must be borne in mind that the granting of patents in this country is practically without control, no attempt having been made to interpose any of the checks urged before the Committee of the House of Lords, in the session of 1851, and provided for in the three Bills of that session, and in the leet of the subsequent session, now the law of the land. The payment of £5 on the first application may be regarded as a registration fee; the applicant makes this payment on lodging the papers, obtaining protection and inchoate rights from the moment of his application. This was one of the cardinal features of the new system of 1852. It has been productive of the greatest benefit to invention, especially to those of the poorer class, by enabling them to obtain inchoate rights, and to create property for themselves by a simple record of their inventions without publicity and the obstruction of interested opponents. This power of placing inventions on record is also resorted to in many cases by those who do not wish further to secure or appropriate to themselves property in their ideas and inventions, which forthwith become public property. The 1500 lapsed patents must be regarded in a different light. These have cost their authors no less than £37,500 for fees and stamps as a direct taxation on their inventive genius, in addition to, and exclusive of, other payments of at least an equal amount. Of these 1500 patents it is believed that the progress of at least 1,000 might be arrested with the *consent* of the applicants if the inquiry before the law-officers were substantial instead of merely nominal. Thus a large useless outlay of capital in money and time would be avoided—talents unprofitably employed would be directed into other channels, and the creation of legal rights would be limited and reduced, exactly in proportion as the applications were not proceeded with.

Your Committee conceive that the application of a portion of the funds contributed by inventors would be most properly applied to affording them this species of protection against the unprofitable expenditure of time and money; the attempt is surely worth the trial; it would effectually check the prostitution of the patent system to the ilegitimate purposes referred to by the Commissioners.

The reward of the meritorious inventor, in cases in which he alone of the public has failed to benefit by the fruits of his genius and the purchase of patent rights in him of extending their terms, was referred to in the Report of the Patent Committee of the British Association at the Leeds Meeting, as a legitimate appropriation of a portion of the surplus.

These objects being satisfied, a very large surplus would remain available for the advancement of science, by researches having a direct bearing on the reproductive industry of the country. And if it be thought expedient that more money should be levied on the granting of patents than necessary for the expense of the office, inventors have, it is conceived, an irresistible claim for the expenditure of that surplus upon objects bearing on their interests and the advancement of science.

W. FAIRBAIRN.
EDWARD SABINE.
THOMAS WEBSTER.

Aberdeen, 16th September, 1859.

A discussion then ensued.

Mr. W. FAIRBAIRN, F.R.S., V.P., laid before the meeting the Memorial of the Manchester Meeting, and expressed his concurrence in the suggestion for the reduction in the cost of patents, or, at all events, that any surplus should be rigidly applied to objects in which inventors have an interest.

Mr. R. ROBERTS—The suggestion as to the cost of a patent being limited to £25 was a delusion; the cost was more nearly £125. No patent ever paid under seven years, and very few under ten years. He did not see why inventors were to be subject to such an infliction or penalty for doing good to their country. If the object was to ob-

struct improvements, the legislature adopted the most efficient means for that purpose. No committee was competent, even if honest, to have the rejection of inventions entrusted to them. He would let inventors have patents at their pleasure, and leave it to litigation or natural death to remove them out of the way.

The Right Hon. JOSEPH NAPIER suggested that a copy of the Report should be sent to the Social Science Association, about to meet at Bradford, and that the requisite improvements in legal proceedings for the protection of the interests of patentees should be the subject of a paper, which he would be happy to support. He had always disapproved of the proceedings before the law officers. He felt ashamed, when a law officer, of having to discharge, without assistance, the duties which they were supposed to discharge, but which was only a mode of paying the law officers.

Professor WILLIS, F.R.S.—One difficulty was, that many persons in perfect honesty reinvented and reproduced inventions which had been tried and failed. Inventors wanted protection against themselves and their own inexperience. They had not the means of knowing what had been done; this opportunity ought to be afforded them; they were entitled to have that information afforded them. They were also entitled to have protection against others who lay in wait, making slight alterations, such as would suggest themselves to any person, and obtained patents for their so-called inventions, which they used for obstruction. Inventors ought not to be taken by surprise, and prevented, when their means were exhausted, from reaping the fruits of their inventions. They were entitled to be protected against themselves and the unfair dealings of others.

At the close of the discussion it was resolved unanimously:—

"That the Committee on the Patent Laws be re-appointed, for the furtherance of the objects set forth in their Report, presented to the Association at this meeting."

DEATH OF PROFESSOR HENFREY.

Professor Henfrey, F.R.S. and F.L.S., Examiner in Botany to the Society of Arts, a Member of the Council of the Horticultural Society, Professor of Botany in King's College, London, and Examiner in Natural Science to the Royal Military Academy, died, at his house at Turnham Green, on the 7th instant.

DRY CLAY BRICK AND TILE MACHINERY.

At the Royal Agricultural Society's show at Warwick, there was exhibited by Mr. H. Chamberlain, a machine patented by Messrs. Bradley and Craven, by means of which bricks, it is said, can be made from perfectly dry clay, so that when moulded, they can be taken direct to the kiln to be burnt. Mr. Chamberlain writes thus concerning it:—

"In introducing this system of brick and tile manufacture, which is no doubt novel to many readers, I must make a few remarks on the advantages they offer over the old plan. Brick-making has been hitherto carried on during a limited season of some six months in each year, or during the long days, as the bricks could not be dried in the winter, and frost would totally destroy them. The result of such a system presses very hard upon the brick labourer, who only finds full employment for one-half his time. Again, a large stock of bricks is obliged to be made, to meet the demands for the winter months, and if trade is not very flourishing the manufacturer has to hold them, or sell them at a great sacrifice. On the other hand, it often occurs that works are seriously delayed in the spring, from the make of the previous year being exhausted, and no further supply can be obtained until the new bricks of the current season are ready for use. The dry clay machines meet these emergencies, for all they require is a shed in which the clay may be stored as it is raised from the earth, a machine house, and kilns. If the clay-shed holds sufficient material for a month or six weeks' consumption, the works can be kept on uninterruptedly during the whole year, giving constant employment to the labourer, and enabling the manufacturer to meet any demand. In districts of the country where coals are cheap the bricks are dried on flues throughout the winter; or where my improved brickworks are erected, they are dried both in winter and summer, by the waste heat of the burning kilns. In the use of flues the consumption of fuel is considerable for this purpose, and therefore greatly increases the cost of manufacture. The saving of labour in making the bricks of dry clay is immense. When made in a plastic state, the clay must be tempered and worked, at great labour, into a perfectly homogeneous mass, and after manufacturing the bricks they have to be spread on drying-floors, or walled on drying-ground, to evaporate the water that it has taken so much trouble to thoroughly mix and work into it. As the drying ground for a large work is necessarily extensive, the labour of the several removals must entail a costly process, while on the dry clay making nothing more is necessary than to throw the rough earth into the machine, when it is delivered out a perfect brick for removal to the kiln at once for burning. The difficulties that arose during the first trials of this system were several, and many expensive experiments were carefully conducted before the machines were sufficiently perfect to introduce to the public. The first serious drawback was the difficulty of expelling the whole of the air from the clay, as the latter made a perfectly tight joint round the pistons before the whole of it was expelled, and the result on its release from pressure was a series of laminated cracks on the face of the brick, caused by the expansion of the air on being released from pressure. This is now entirely mastered in these machines. Another difficulty also presented itself, viz. that a machine which would make a perfect brick from a strong plastic clay if quite dry and very fine sifted, was quite useless if the clay was damp. The machines I now introduce have overcome these defects, and will work equally well with clay dry or damp, coarse or finely sifted. In practice it is found advisable with strong clays to use a portion of sand with the earth, the same as in plastic clay manufacture. The pressure can be regulated to anything desired, so that bricks can be made of the densest description for engineering purposes, or they may be made of as open a texture as the hand-made brick, by giving less pressure, and the addition of sand to the clay.

"For fire-brick making these machines are particularly adapted, and in case of existing works that have proper grinding mills, the machine only is necessary."

Proceedings of Institutions.

BIRMINGHAM (MESSRS. CHANCE'S) LIBRARY AND READING ROOMS.—The last report states that the members have increased considerably, the average number per quarter for 1858 being 209, whilst in 1857 it was only 174, giving an increase of 35 members per quarter. Although this shows a satisfactory progress, as compared with some former reports, the committee desire to remind the friends of the Institution that in 1856 the average was 228. The reading-room is now attended more regularly and numerously than at any former period. The library has been increased within the year by the purchase of 120 additional volumes. The average issue of books has increased from 10 to 15 per day. The balance of £24, left in the hands of the committee at the close of the last year, was to be devoted to the further improvement and enlargement of the library. Three lectures have been delivered, one by the Rev. B. Willmore, on "The Wooden Walls of Old England;" one by Sebas-

tian Evans, Esq., on "John Milton—his Life and Times;" and the third and last by Henry Chance, Esq., on "John Howard, the Philanthropist." The attendance upon each occasion was considerably above the average of that of former years. The committee draw particular attention in this report to the advantages of the Society of Arts' Examinations, and urge upon the members the importance of availing themselves of them. This appeal has been to some extent responded to, as is shown by the reports of the Examinations held in May last.

BRADFORD MECHANICS' INSTITUTE.—The twenty-seventh annual report of the Bradford Mechanics' Institution shows that the number of the various classes of subscribers on the 31st of March last was as follows:—Life members, 128; members at 12s. per annum, 442; subscribers at 10s., 158; subscribers at 8s., 338; female subscribers at 6s., 39; firms, 11; persons nominated by firms, 87—Total, 1203. The total number on the books at the corresponding period of the previous year was 1240, which gives a decrease on the present year of 37. The cash account of the treasurer is less satisfactory than that of the preceding year, the receipts from subscriptions having fallen short by £41 5s. 5d. of the amount derived from this source in the previous year. This unfavourable result, however, is almost entirely confined to the first two quarters of the year; and, to a great extent, may be accounted for by the depression in trade which at that time prevailed, and the great lack of interest in news relating to political and public affairs. The gross receipts of the year, exclusive of a balance of £70 19s. 2d. from the previous year's accounts, have been £662 8s.; while the expenditure has amounted to £703 6s. 10d., giving an excess of expenditure over income of £40 18s. 10d. This result is chargeable to the payment of upwards of £51 for printing the new catalogue; and as the receipts from the sale of catalogues have as yet scarcely amounted to £20, the difference between these sums may be considered available as income in the ensuing year. In addition to this, a cash balance of £30 0s. 4d. is still remaining in the bankers' hands. The circulation of books from the library attests the high estimation in which this department is held by the members. During the 293 days the library has been opened, the number of volumes issued has amounted to 30,359, or an average of 103·180 per day. Although a large proportion, fully one-third, of this number comes under the classification of fiction, a considerable use has also been made of the more solid and useful books with which the library is plenteously supplied. It must be remembered, in estimating the value of this department, that the majority of those who avail themselves of its privileges are thus making their first acquaintance with the world of letters; and that their principal inducement has been to vary and relieve the ordinary avocations of daily life. The Committee refer with much pleasure to the new catalogue, published in September last, which in all respects is very greatly superior to the one previously in use. The number of volumes added during the year has been, by purchase, 180; by bound periodicals, 45; by donations 10;—total, 235. In addition to these, 49 volumes have been purchased to supply worn out books. The total number of volumes at present in the library, including 13 duplicates, is 7136. In the class department the teachers report generally in favourable terms of the diligence, good conduct, and attainments of the pupils. It is to be regretted, however, that the classes have been of a more elementary character than those of previous years. This has arisen chiefly from the difficulty of obtaining suitable gratuitous teachers—the extremely low rate of subscription paid by the members precluding the employment of any other kind of aid. From this cause alone the classes for mathematics, book-keeping, and English literature were obliged to be omitted from the operations of the past session. As it is very desirable, however, that important classes like these should be efficiently and regularly conducted in the Institute, it has been matter for consideration whether it would not be advisable, in the next session, to fix an additional fee for these classes, as is the case with those for German, French, and drawing, and by this means secure the services of competent persons to conduct them. The class for the study of animal physiology was opened too late in the session to acquire any decided success. With these exceptions, the class instruction of the past year has been well maintained, with an attendance equal to that of previous years, and with the like satisfactory results. The average attendance at the classes during the last session has been as follows:—Writing and arithmetic, 118; reading (two classes), 60; elementary grammar, 14; elementary grammar (2nd class) 29; grammar (advanced class), 9; geography, 20; English history, 9; chemistry, 16; animal physiology, 5; Latin, 4; French (three classes), 28; German, 15; drawing, 23. At the annual soirée various prizes were distributed to the successful pupils. The certificates awarded by the Society of Arts were also distributed on the same occasion. By the kindness of Alfred Harris, Jun., Esq., (to whom the Institute, and especially the members of the drawing classes, are greatly indebted for the encouragement he has afforded them in their studies), special prizes of £4 and £1 10s. were respectively awarded to John Sowden and W. M. Arundale, for two very excellent drawings from the plaster cast. The following lectures were delivered during the past session. Those marked with an asterisk were gratuitous:—Miss Glyn, reading of the "Merchant of Venice," "Romeo and Juliet," and "Macbeth;" *Rev. J. H. Ryland, President, "Early Life and Writings of Milton;" *W. E. Forster, Esq., "Passages from the History of the House of Lords;" George Grossmith, Esq., "Humorous Characteristics" and "Martin Chuzzlewit;" *Rev. J. R. Campbell, M.A., "Izaak Walton;" Geo. Dawson, Esq., M.A., two on "Good Queen Bess;" Gerald Massey, Esq., "Charlotte Bronte;" *Rev. S. G. Green, B.A., "Writings of Thomas Carlyle;" Walter Rowton, Esq., "Thomas Hood;" *J. V. Godwin, Esq., "British Commerce in the 17th and first half of the 18th Century;" Mrs. C. L. Balfour, "Domestic History of the Bonaparte Family;" *Rev. J. P. Chown, "George Washington."

CHELMSFORD LITERARY AND MECHANICS' INSTITUTION.—On Wednesday evening, the 12th ult., a muster of friends of this institution assembled in the hall, to witness the presentation of an elegant dressing-case, value 10 guineas, with a purse of 25 sovereigns, to Mr. J. W. Hair, the respected hon. secretary, as a token of the esteem and gratitude of the members for his able and assiduous discharge of the duties of his office during the last five years. W. W. Duffield, Esq., presided, and briefly addressed the audience, expressing his sense of his own inability adequately to discharge the pleasing duty deputed to him, and regretting that a gentleman (Major Skinner) who would have discharged the duty much more ably and efficiently was unavoidably absent. Turning then to Mr. Hair, the chairman presented the testimonial, begging him to accept it, not as a pecuniary recompense, for it would be a very inadequate one, but as a small expression of their gratitude for the valuable services he had rendered them, and for the most exemplary manner in which he had discharged gratuitously the duties of his office. He begged him to accept the small but valuable present—valuable as expressing towards him their sense of the services rendered, and as showing their kind and grateful feelings. He read the inscription on the dressing-case, which, he said, expressed the feelings and sentiments of every member of that institution. He thought, and he was sure Mr. Hair would agree with him, that the best and most grateful sense a man could have of services performed was the approval of his own mind and conscience, and he was sure Mr. Hair experienced that satisfaction in the highest degree. He was

sure Mr. Hair would receive their testimonial with pleasure and satisfaction, and he hoped that the Institution might long continue his services as hon. secretary. He could only further, in his own name and in the name of the Institution generally, express a hope that Mr. Hair might live for many years in possession of every happiness it was possible for man to enjoy; and he was quite sure he would never have occasion to regret having rendered to the Institution the valuable services he had done. Mr. Hair, who was enthusiastically received, acknowledged the gift in an appropriate speech, explaining the circumstances under which, in conjunction with the late Mr. Valpy, he had been induced with much diffidence and hesitation to accept that office, the duties of which he was proud to have discharged to their satisfaction. It was a matter of gratification to him to have been selected for such an office, and he trusted—nay, the proceedings of to-night had convinced him—that his services had been appreciated. He conveyed, in appropriate language, his gratitude to the members for the handsome manner in which they had marked their approval of his services; to the committee for the way in which they had acted in the matter, and for the assistance they had always rendered him; to the chairman for his kindness in presiding; and resumed his seat amidst loud applause. The proceedings closed with a most cordial vote of thanks to the chairman. The Committee have made arrangements for their next lecture session (Oct. to April), having engaged the following professional lectures, &c. Dr. Daniel (four lectures). Mr. Stocqueler, Mr. Robert Hunt, Mr. Parsons, Mr. George Dawson, Mrs. Balfour, Mr. Basil Young, Mr. H. Nicholls, Mr. Pepper, the Rev. P. Wood, Miss Bleadon, and Mr. A. Nicholson; and the following have kindly consented to lecture gratuitously:—The Rev. E. Sidney, M.A., the Rev. J. G. Davies, M.A., Mr. Marshall of Burnham, Mr. H. S. Richards, Mr. Sharman, Tindall Atkinson, Esq., and the Rev. J. G. Hughes.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 16th*, 1859.]

Dated 1st September, 1859.

1993. J. A. Simpson, Liverpool—Imp. applicable to hats and other coverings for the head.
1995. T. Aveling, Rochester, Kent—Imp. in locomotive engines.
1997. R. H. Collyer, 8, Alpha-road, Regent's-park—Imp. in preparing materials for the manufacture of paper.

Dated 2nd September, 1859.

1999. J. Bernard, Albany, Piccadilly—Imp. in the manufacture or production of boots and shoes, in the machinery, apparatus, and means employed in such manufacture.
2001. W. Brown, jun., and S. Bathgate, Selkirk, N.B.—Imp. in machinery or apparatus for grinding or sharpening the card teeth of carding engines for carding fibrous materials.
2003. W. Fearn, Leeds—An improved construction of buoy.
2005. S. D. Goff, H. Davis, S. Strangman, and E. Strangman, Waterford—An improved method of, and apparatus for, drying malt, corn, and other articles.
2007. E. Button, Smith's-terrace, Chelsea—Improved apparatus for raising sunken vessels.

Dated 3rd September, 1859.

2011. J. Friou, 74, Newman-street, Oxford-street—Detaching instantly the locomotives from railway carriages, and also for detaching instantly the harness from horses that run away when attached to any carriage.
2013. H. R. L. Schramm, Breslau, Prussia—A new process for pressing and separating simultaneously the fibres and pellicles contained in the constituent matters of the beetroot, sugar, beer, grains, alcohol, potatoes, beets, and other similar substances.
2015. W. Neilson, Glasgow—Imp. in steam hammers.
2017. J. C. Nixon, Nottingham—Imp. in kitchen ranges, with combined steamer and hot closets, for cooking, warming, drying, or other purposes.
2019. C. Schiele, Oldham, Lancashire—Imp. in weighing machines.
2021. B. Lauth, Manchester—Imp. in the manufacture of rollers or cylinders for calico printers, and of tubes of copper and brass, or mixtures of those metals.

Dated 5th September, 1859.

2023. W. Bush, Dulwich, Surrey—Manufacturing granulated seidleitz powder.
2025. J. W. P. Field, 233, High Holborn—Imp. in breech-loading fire-arms.
2027. V. Tomell, 294, King's-road, Chelsea—Imp. in the manufacture of yeast.
2029. A. V. Newton, 66, Chancery-lane—Imp. in weighing machines. (A com.)

Dated 6th September, 1859.

2031. R. K. Geldard, Plymouth—Imp. in the method of, and apparatus for making pharmaceutical or other infusions.
2033. F. J. Manceaux, Paris—Imp. in cartridges.
2035. J. Stewart, 66, Tottenham Court-road—Imp. in pianoforte action.

Dated 7th September, 1859.

2037. J. J. Lyons, London—Imp. in the manufacture of sugar.
2039. G. Lawrence, York-road, Battersea, Surrey—Imp. in the construction of wheeled vehicles.
2041. W. J. J. Varillat, Rouen, France—An apparatus indicating the level of water in steam caldrons or boilers.
2043. J. P. Joule, Manchester—Imp. in apparatus for refrigerating and condensing steam or other vapours, which said improvements are applicable to refrigerating or heating liquids.
2045. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of ladies' hooped skirts. (A com.)
2947. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for forging metals. (A com.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2072. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved arrangement of piston packing, principally applicable to hydraulic apparatus. (A com.)—12th September, 1859.
2073. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction of hydraulic pumps. (A com.)—12th September, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, September 16th*, 1859.]

September 15th.

660. I. Ash.
664. W. Avery.
671. T. W. Miller.
672. C. Defries.
676. R. A. Brooman.
678. A. G. Hutchinson.
679. P. Larochette, sen.
681. A. Warner and W. H. Tooth.
684. W. B. Taylor.
690. R. Mushet.
691. R. Mushet.
692. A. L. Thirion.
693. C. Lambert.
694. J. W. Duncan and J. E. A. Gwynne.
696. W. B. Gingell.
700. J. W. Hart.
702. J. Howden and A. Morton.
703. R. Mushet.
707. W. Haggett.
712. J. Roberts.
713. S. Leoni.
714. J. Bickerton.
717. W. Rhodes.
727. D. L. Banks.
736. W. Adamson.
790. W. Brown.
792. J. W. Hadwen.
795. T. D. Shipman.
802. J. Lacy, S. Simpson, and H. Smith.
805. T. Ivory.
806. T. Ivory.
857. N. Libotte.
942. W. Sinnock.
1028. W. Stevenson.
1038. W. E. Newton.
1162. A. V. Newton.
1180. T. P. Bennett.
1493. A. Parkes.
1647. W. E. Newton.
1687. W. M. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, September 16th*, 1859.]

September 10th.

2115. S. White.
2124. P. A. Balestrini.

September 12th.

2059. Capt. J. M. Hayes, R.N.
2142. E. Green.
2147. F. D. Monod.
2159. S. Chodzko.

September 13th.

2157. G. C. T. Cranstoun, G. Young, and J. Lovell.

September 14th.

2174. D. Crichton and J. Cathcart.
2200. A. Templeton & J. Lawson
2202. W. Young.
2294. J. Holman.

[*From Gazette, September 20*, 1859.]

September 16th.

2175. J. Barber.

September 17th.

2203. E. Finch.
2206. J. Underwood and F. V. Burt.
2218. W. Taylor.
2253. S. Calley.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

September 17th.

120. G. Collier.